



Regreening Yosemite. SCA's Conservation Career Development program includes projects like revegetation of parks.

and Wildlife Service, among others. Foundations, corporations, and other supporting organizations provide additional funding.

In addition to the high school and resource assistant programs, SCA sponsors a program dedicated to bringing cultural diversity to the conservation workforce. The Conservation Career Development Program (CCDP), funded by a grant from the National Fish and Wildlife Foundation, seeks to broaden the conservation arena by involving people within the context of their own cultures. According to Cameron Bayne, a CCDP High School Component Supervisor, "Our environment is diverse, and those who care for it should be as diverse."

Butadiene and Styrene Risks

Workers in plants that manufacture synthetic rubber and reinforced plastics are being exposed to levels of butadiene and styrene gases thousands of times greater than the general population, possibly correlating to greater risk of cancers and other occupational health hazards.

Such was the evidence presented at an international symposium on "Health Hazards of Butadiene and Styrene" held in Finland in April. More than 160 scientists from 17 countries attended the symposium, organized by the Finnish Institute of Occupational Health and the International Agency for Research on Cancer.

The United States currently produces approximately 3 billion pounds a year of butadiene, mainly for the production of synthetic rubber, and 9 billion pounds a year of styrene, used in plastics and products such as Styrofoam. Though the general

population may be exposed to these gases in the air, cigarette smoke, water, or foods, the major concern of the symposium was for workers in these industries whose exposures far exceed environmental levels.

Current occupational exposure to butadiene in the United States is generally less than 10 parts per million (ppm), with measured excursions as high as 374 ppm, compared to urban air concentrations of 1–10 parts per billion (ppb). Although OSHA has proposed lowering the permissible occupational exposure level to 2 ppm, this proposal has not been implemented, and the level remains at 1000 ppm. Cancer risk estimates for workers exposed to the proposed 2 ppm standard range from 0.2 per 10,000 workers to 600 per 10,000 workers, depending on the type of tumor.

Average exposures to styrene in polystyrene manufacturing plants are less than 5 ppm. In the reinforced plastics industry, average concentrations are 45 ppm, though peak concentrations may reach hundreds of parts per million.

Health risks to animals and humans from exposure to butadiene and styrene, including genetic damage and cancer, were presented at the symposium. Epoxide intermediates of butadiene were shown to cause gene mutations at both the *hprt* and *tk* loci in human lymphoblastoid cells and at the *hprt* locus in mouse splenic lymphocytes. Increases in chromosomal damage in human lymphocytes were reported in a number of studies of workers exposed to styrene; however, the dose-response relationships are not clear.

Lung tumors have been induced in mice at the lowest concentration of butadiene (6.25 ppm) ever used in a long-term study. Gene mutations in the p53 tumor-

suppressor gene, analogous to those found in a wide variety of human cancers, were characterized in both lung and mammary gland tumors in mice. Although no adequate inhalation studies have been reported for styrene, gavage exposure to styrene oxide, a metabolite of styrene biotransformation, caused forestomach tumors in rats and mice.

Epidemiology studies reveal associations between occupational exposure to butadiene and deaths due to leukemias. A case-control study of leukemias in plants that manufacture styrene and butadiene rubber showed a seven- to ninefold increase in risk for workers exposed to butadiene, although some believe the risk is actually much lower or nonexistent. Though no such association was shown for styrene, small increased risks of leukemias and lymphomas were reported in workers exposed to styrene in the reinforced plastics industry.

Development of physiologically based pharmacokinetic models of the uptake, tissue distribution, and metabolism of styrene and butadiene in the rat, mouse, and human was presented at the symposium. Differences in internal doses of mutagenic epoxides in rats and mice are too small to account for the different carcinogenic effects of butadiene in these species. Discussions also highlighted the need for more information on metabolism of these chemicals in organs other than the liver and lung. There appear to be two groups among the human population with different levels of sensitivity to the genotoxic effects of these chemicals. More research is needed on the metabolic variability of humans, particularly in susceptible populations. New markers of exposure for butadiene and styrene were also presented at the conference, which scientists hope may be useful for human biomonitoring and provide some of the much needed information to evaluate human risks from exposure to these two chemicals.

Kids at Risk

Children may be at increased risk for effects of pesticides, a National Academy of Sciences report concluded in July. The report cited deficiencies in the way the government calculates safe levels of pesticides on foods and its regulation of pesticides.

The NAS report, *Pesticides in the Diets of Infants and Children*, states that children might be highly sensitive to pesticides on food and that they consume 60 times more fruit than adults, leading to higher doses of pesticides. "Older infants and young children may metabolize pesticides more exten-